

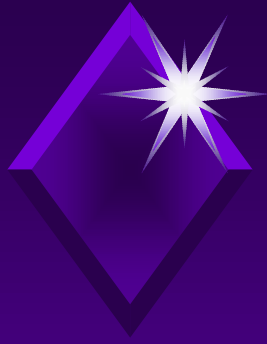
Performance Graded (PG) Asphalts



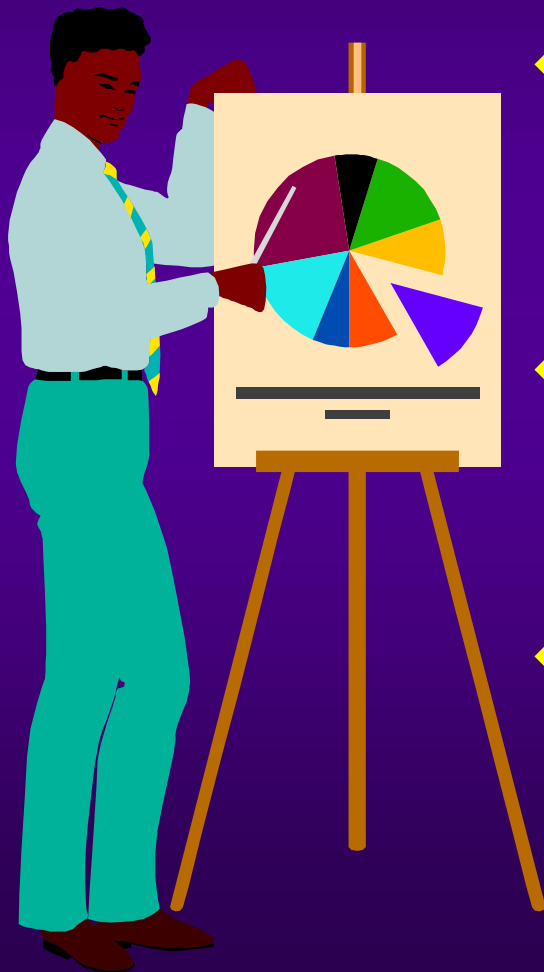
Asphalt

A Driving Force In Asphalt

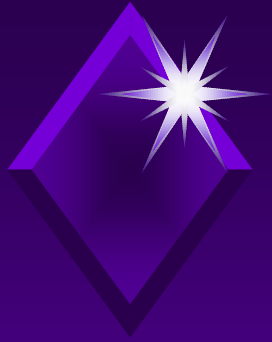
**TS Airfield Workshop
Fort Lauderdale, FL
March 29, 2004
Frank Fee**



What is SUPERPAVE?

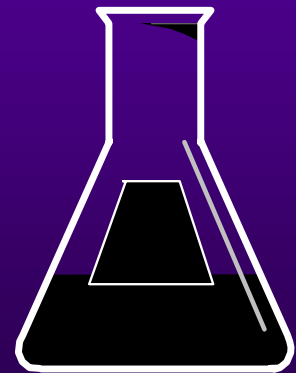


- ◆ New Asphalt Binder specification
- ◆ New Mix Design procedure using a new laboratory compaction device
- ◆ For highway applications

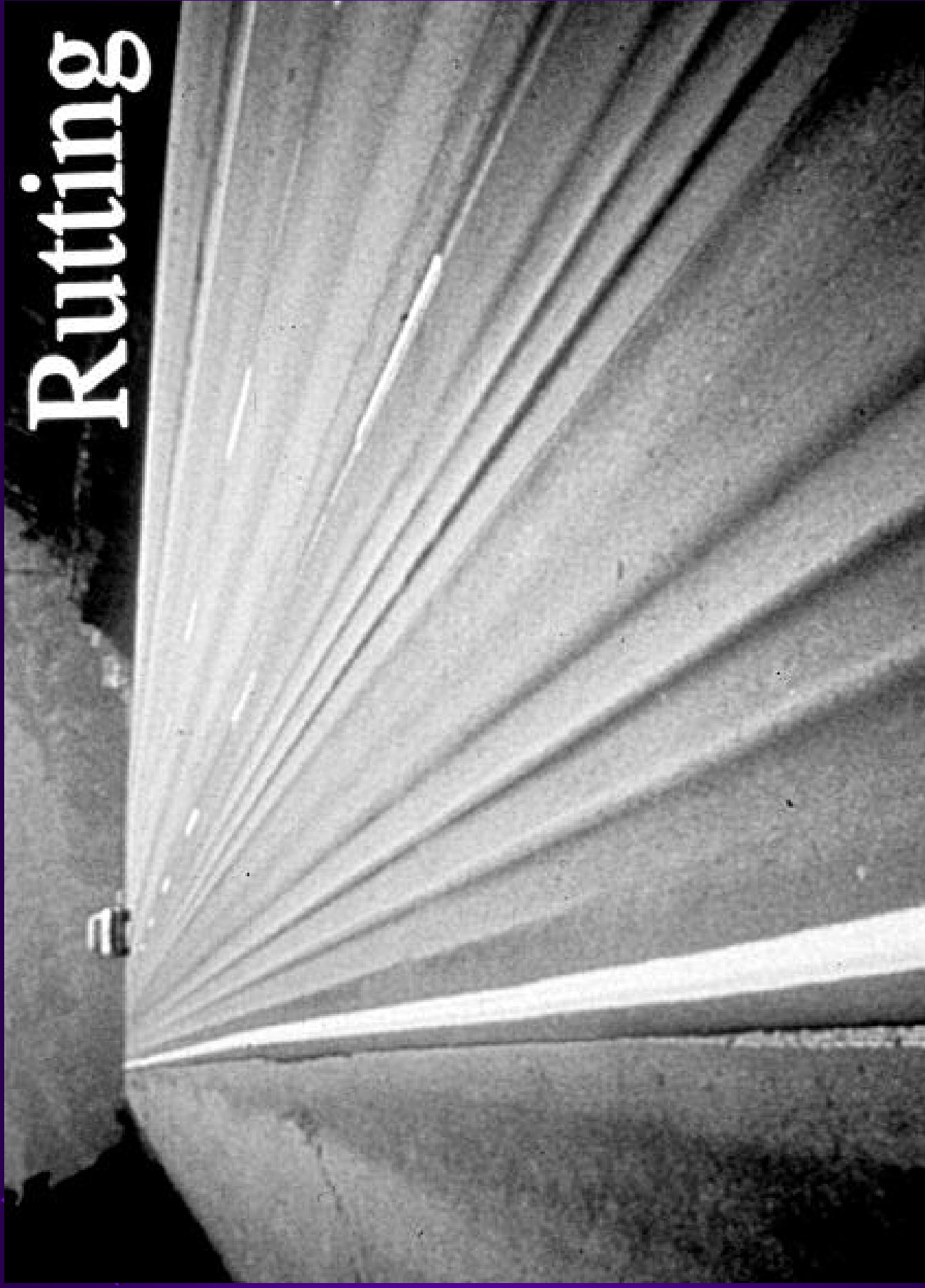


Performance Related Specification

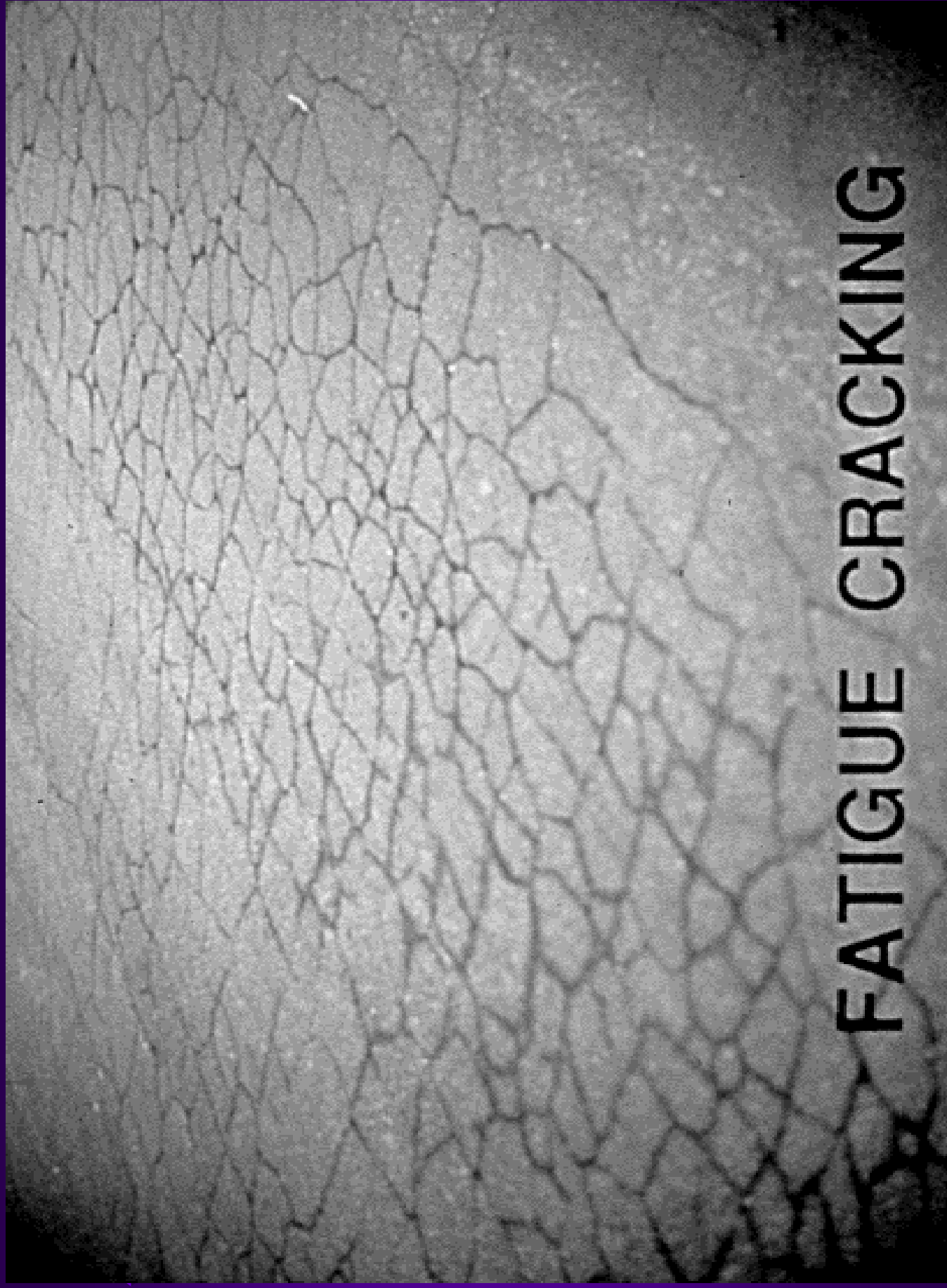
- ◆ Identifies performance issues
- ◆ Employs tests and specifications that address these issues



Rutting

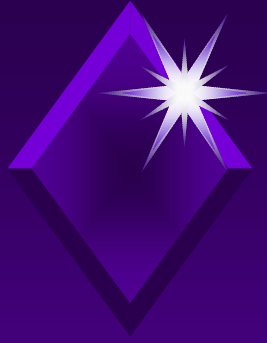


FATIGUE CRACKING

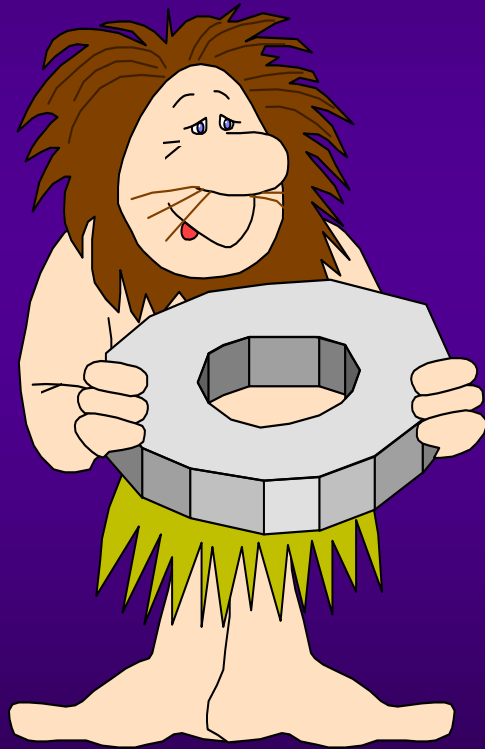


Low Temperature Cracking





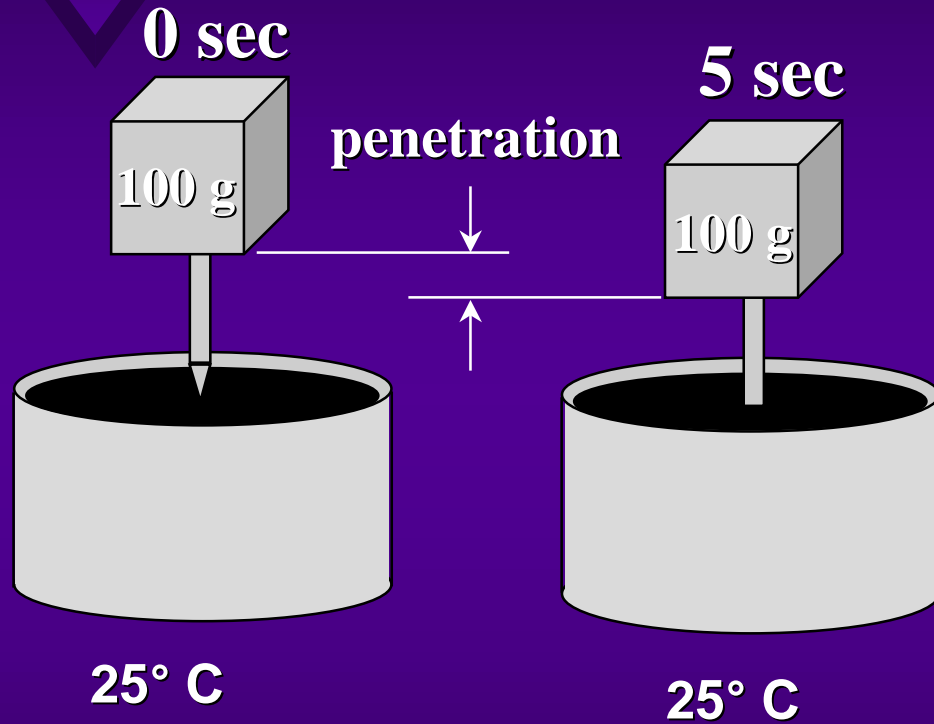
How Did We Measure Asphalt Properties Before the PG Grading System?



- ◆ Penetration Grading
- ◆ Viscosity Grading

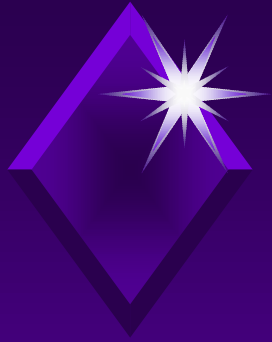


Penetration



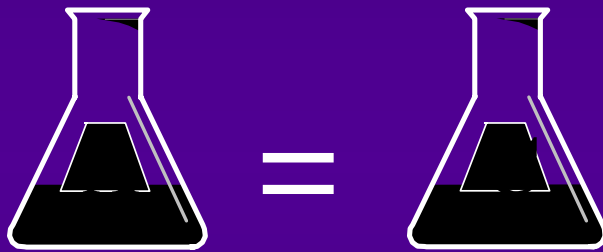
Viscosity



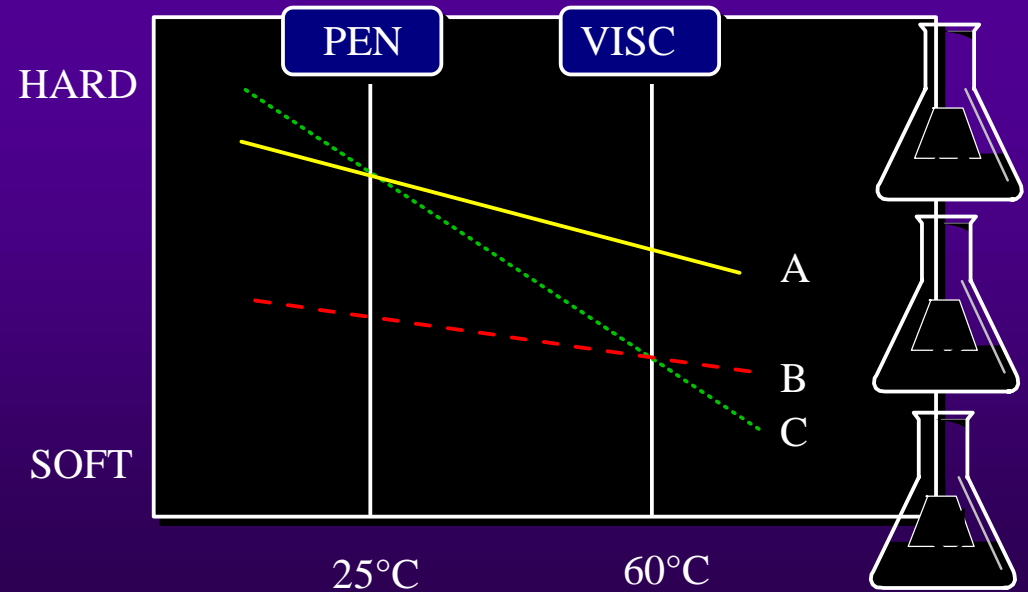


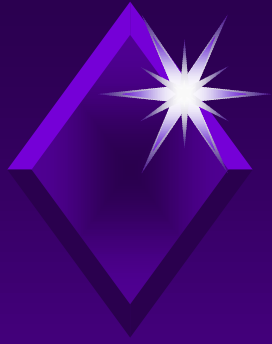
Problem with one temperature grading

◆ According to the Penetration system:



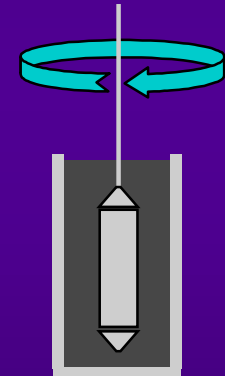
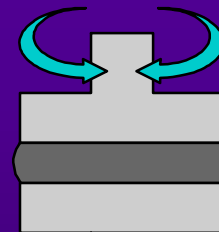
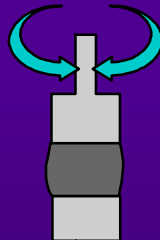
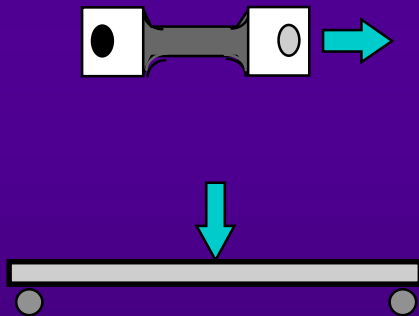
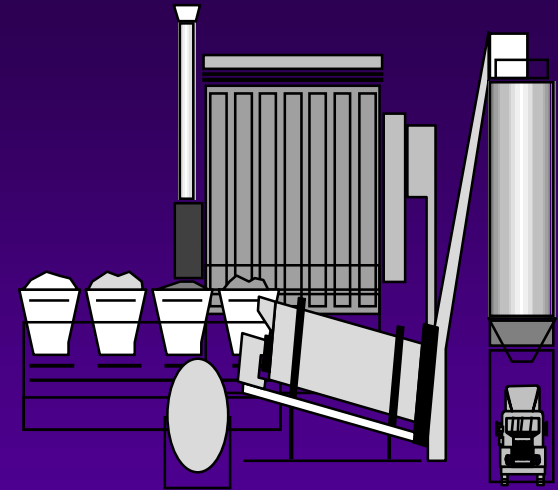
◆ According to the Viscosity System:



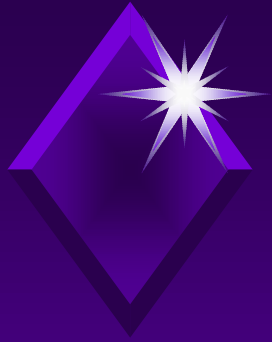


PG Binder Specification

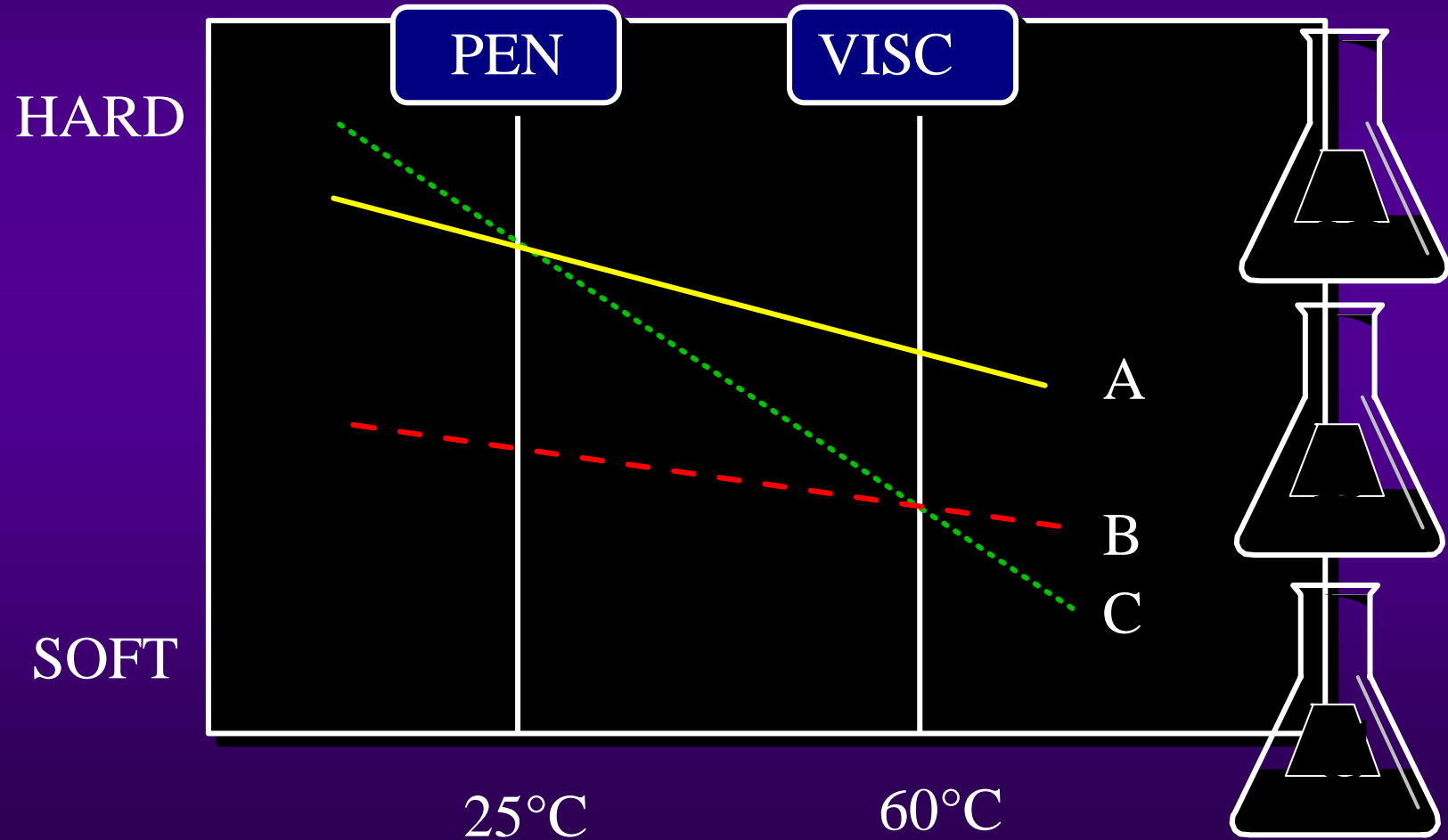
- ◆ **Develop Performance Related tests and specification**
- ◆ **Recognizes that Asphalt is a visco-elastic material that is temperature dependant**
- ◆ **Therefore protocols need to be temperature based**

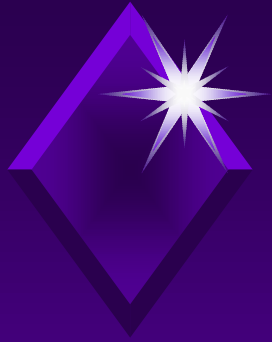


Pavement Temperature, C
New Performance Related Tests



Problem with one temperature grading





Weather Database Performance Grade Increments

Average 7-day Maximum Pavement
Temperature

46	52	58	64	70	76	82
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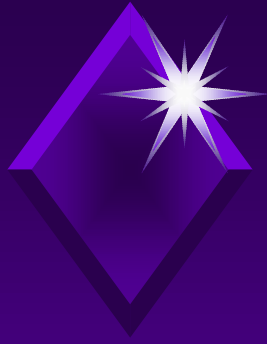
Average 1-day Minimum Pavement
Temperature

-10	-16	-22	-28	-34	-40	-46
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PG Spec based on Temperatures and Stiffness

- ◆ 1. Rutting occurs at high pavement temperatures, $T_{(high)}$ = **Minimum stiffness**
- ◆ 2. Fatigue Cracking occurs at intermediate pavement temperatures, $T_{(inter)}$,
= **Maximum stiffness**
- ◆ 3. Low Temperature Cracking occurs at low pavement temperatures, $T_{(low)}$
= **Maximum stiffness**



Superpave Asphalt Binder Specification

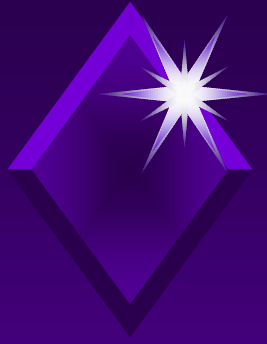
◆ Grading System Based on Climate

PG 64-22

**Performance
Grade**

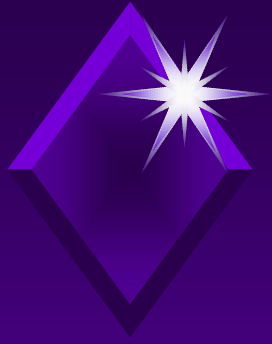
**Average 7-day
max pavement
design temp**

**Min pavement
design temp**



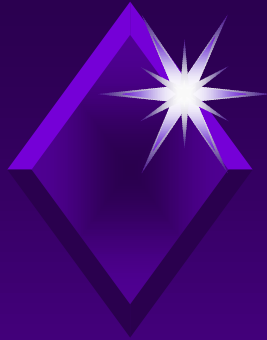
New PG Binder Spec – Use on airports

- ◆ **Based on *fundamental engineering properties* (stiffness) and the *environment of the specific project***
- ◆ **Provides a more complete characterization of the temp – stiffness curve for binders**
- ◆ **Developed for use in US only**



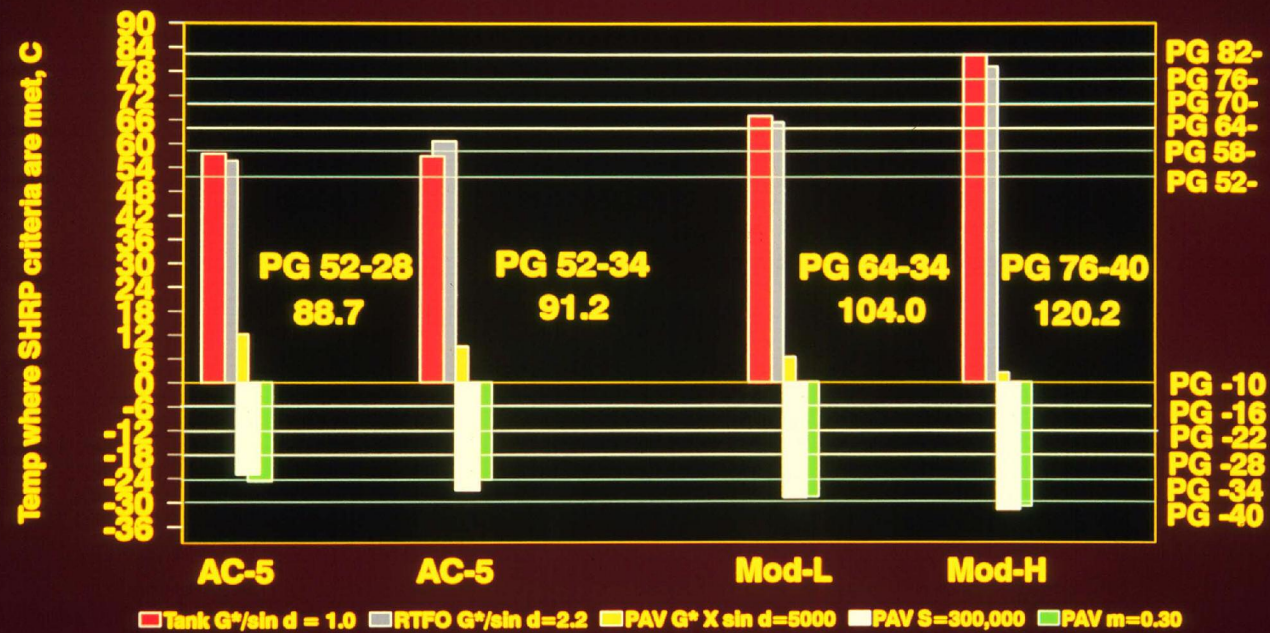
PG binder – use on airports

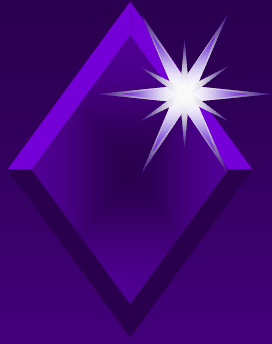
- ◆ **Most airfield paving fails due to cracking**
- ◆ **Thermal/fatigue due to aging**
- ◆ **Some rutting at high traffic airports – taxiway/end of runway**
- ◆ **PG spec – potential for better utilization of binder for specific projects**



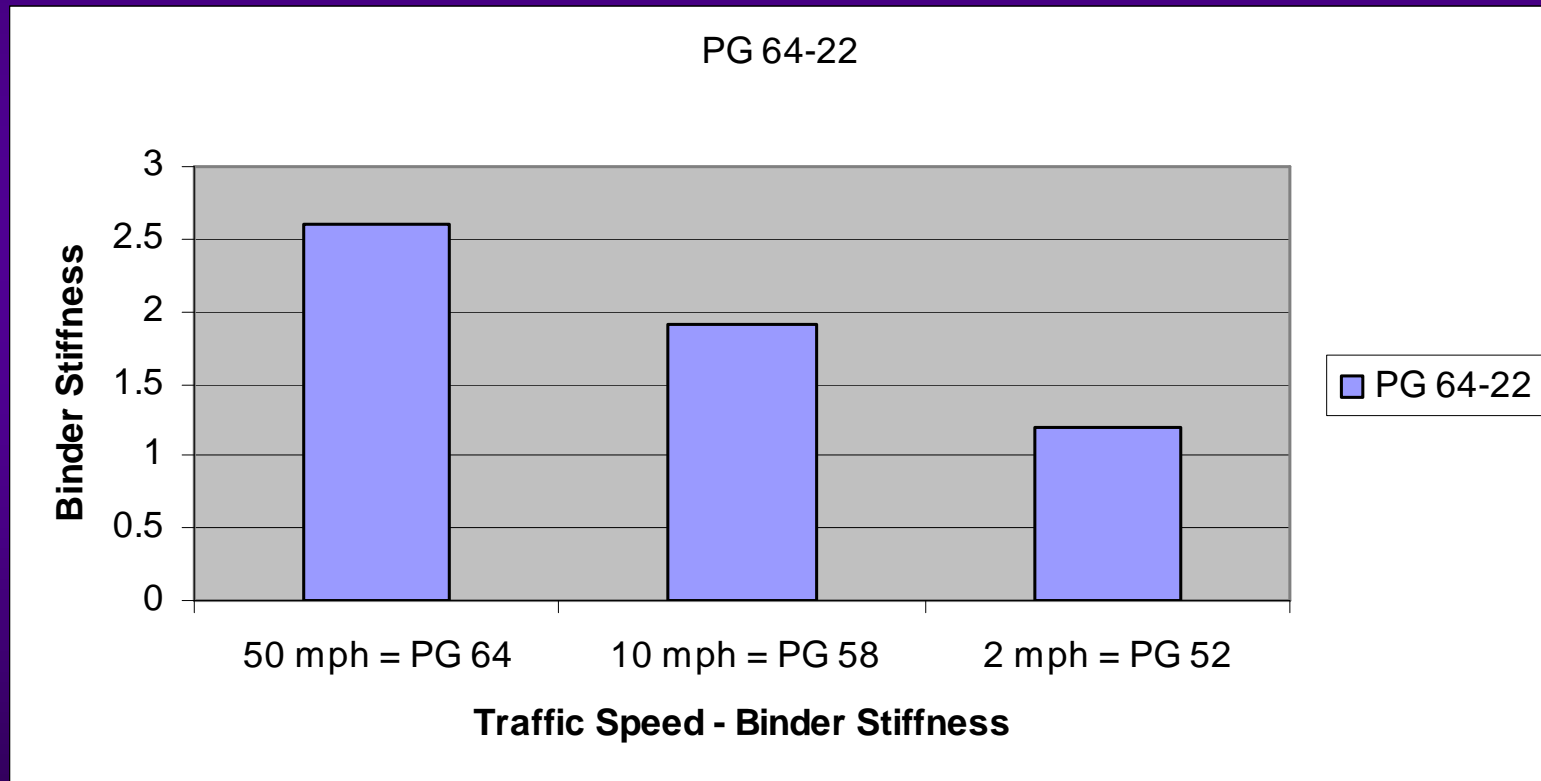
PG is not the same as vis. Grade

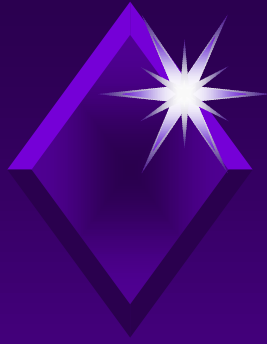
Unmodified and Modified AC From Different East Coast Sources





Also provides for the effect of loading speed – applicable for taxiways

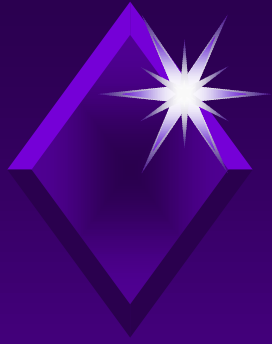




Issues related to Polymer Modified Asphalt (PMA)

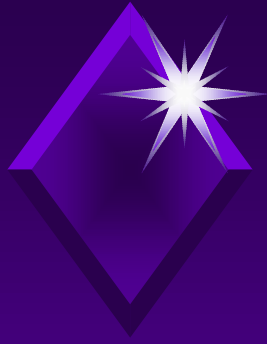
◆ Background

- ◆ In the 80's & 90's – state DOT's did lab research, field validation and eventually spec
- ◆ Most widely specified = elastomeric (SBS – SBR)
- ◆ Also some plastic modifiers (EVA – LDPE)



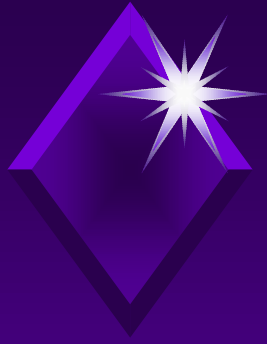
Goal of PG spec is to be totally performance based

- ◆ Unfortunately this goal has not been attained yet for PMA's
- ◆ In the interim – PG + spec (elastomeric only)
- ◆ If want to use a PMA - Follow state highway agency spec



Why use PG binder spec in the US

- ◆ **50 out of 52 states now use this spec exclusively**
- ◆ **US asphalt supply industry has switched to manufacturing predominately PG grades (pen and vis graded products – no longer available)**



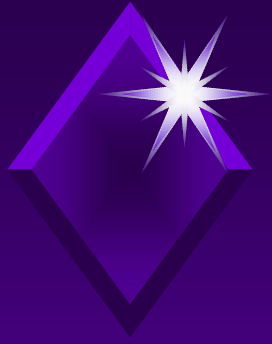
How to specify PG binder

- ◆ **UFGS – 02749 sec. 2.2 Asphalt Cement binder – Note: PG binders**
- ◆ **Select “standard grade”* required by the state DOT for the location of the airport (* not adjusted for heavy traffic or slow speed)**
- ◆ **Do not spec any PG grade with a low temp higher than -22 (e.g. no PGxx-16)**



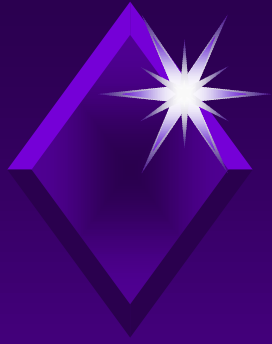
How to specify PG binder

- ◆ If there is a concern about rutting or indentations (e.g. on taxiways or end-of-runway) need to consider “bumping” the high temp grade
- ◆ “bump” should only be used:
 - ◆ On runways, taxiways, and parking areas – not for shoulders



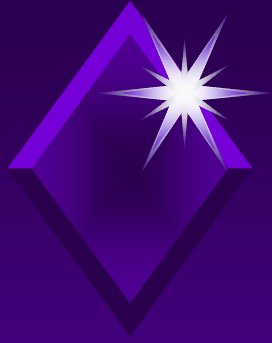
How to specify PG binder

- ◆ “bump” should be used as follows:
- ◆ Design - 200 psi tire = 1 HT grade increase (e.g. PG 64-22 to 70-22)
- ◆ Design + 200 psi tire = 2 HT grade increase (e.g. PG 64-22 to 76-22)
- ◆ NO adjustment to the low temp grade



How to specify PG binder

- ◆ Help ?
- ◆ Mark Buncher – e-mail
MBuncher@asphaltinstitute.org
- ◆ Frank Fee
ffee@citgo.com



Questions?